

## **CO<sub>2</sub> injection-induced seismicity in deep sedimentary rock and volcanic areas**

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### **Abstract**

The urgency of action to reduce CO<sub>2</sub> emissions to mitigate the climate crisis requires to upscale carbon capture and storage (CCS) to the gigaton scale. The injected CO<sub>2</sub> not only does induce pressure buildup, but also cooling around the injection wells. Such changes may induce seismicity, which, if felt, could cause nuisance to the local population and damage to infrastructure and could eventually lead to project cancellation. To understand the processes that may induce seismicity in CCS projects, we perform coupled thermo-hydro-mechanical simulations of CO<sub>2</sub> injection both in deep sedimentary rock and deep volcanic areas. We have recently proposed to extend CO<sub>2</sub> storage to deep volcanic areas because, there, CO<sub>2</sub> becomes denser than the resident pore water, which stays in its supercritical state. Simulation results show that CO<sub>2</sub> injection in deep sedimentary rock has a low potential of inducing seismicity because 1) the stress state is generally not critically stressed and sedimentary rocks are quite ductile, 2) pressure buildup is easy to control because it becomes practically constant, because of the low viscosity of CO<sub>2</sub>, after an initial sharp increase at the beginning of injection, and 3) cooling around injection wells induce thermal stresses reduction and a stress redistribution around the cooled region that tightens the caprock, improving its stability in normal faulting stress regimes. In deep volcanic areas, cooling-induced seismicity may dominate after a few years of injection because of the larger temperature contrast and thus, thermal stress reduction, that could reactivate faults located hundreds of meters away from the injection well. Nonetheless, CO<sub>2</sub> storage in deep volcanic areas is a new concept that requires further investigation.

### **References**

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